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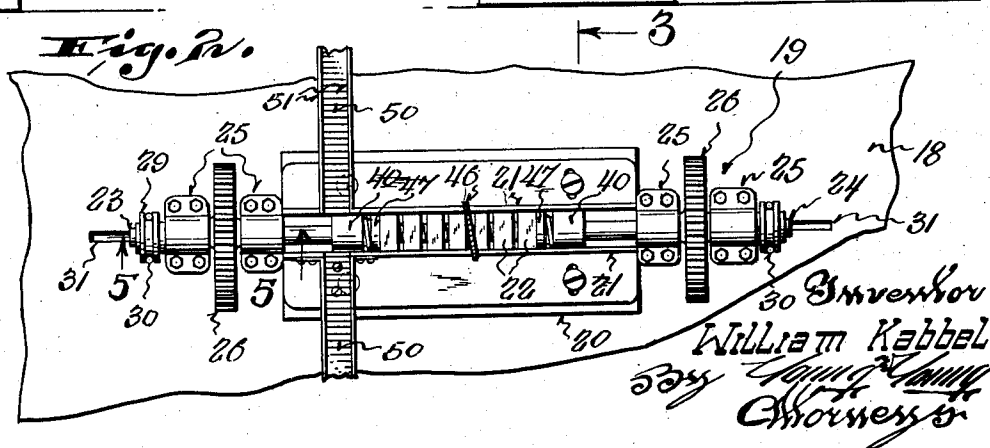
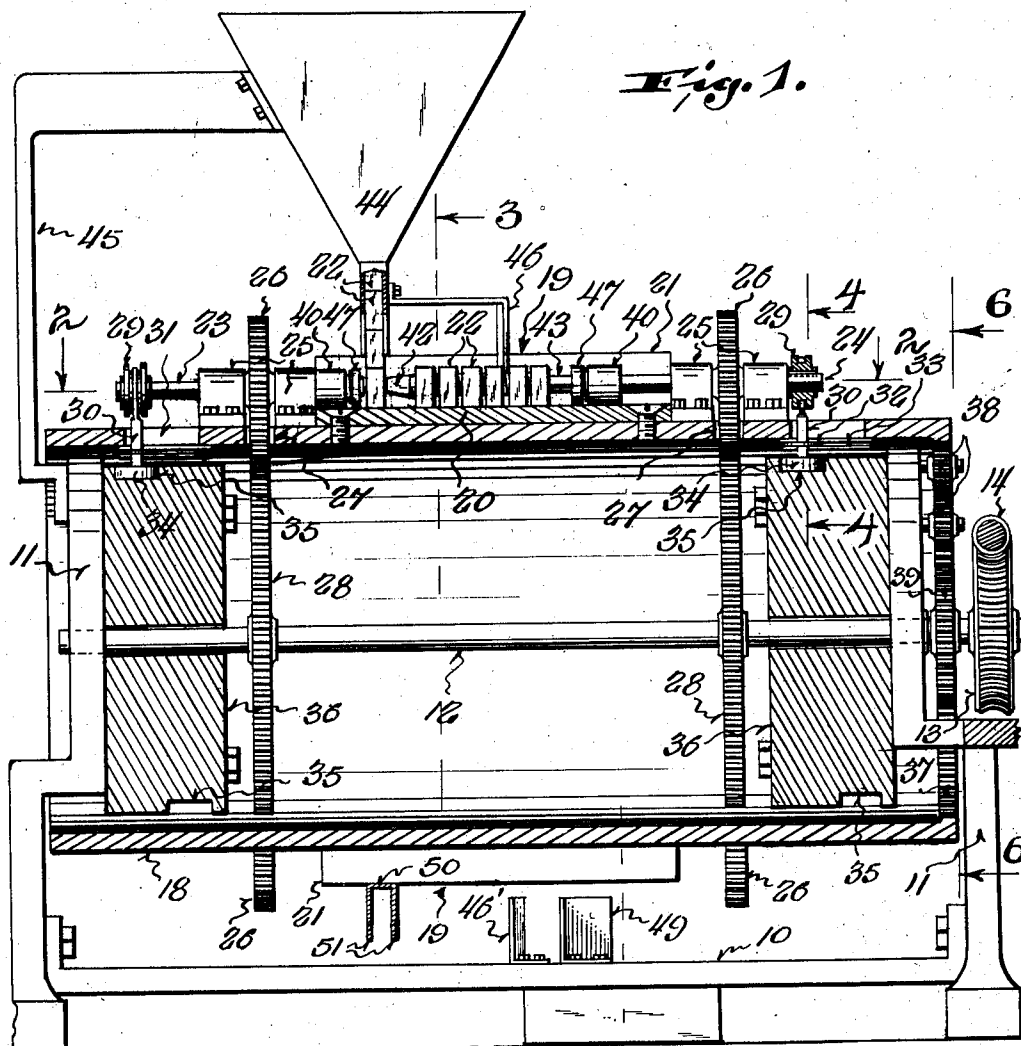
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AUTOMATIC TAPPING OR DRILLING MACHINE

Filed July 26, 1933

3 Sheets-Sheet 1



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Fig. 5.

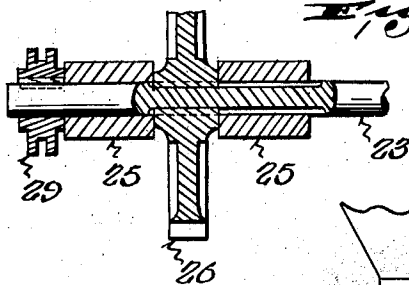


Fig. 6.

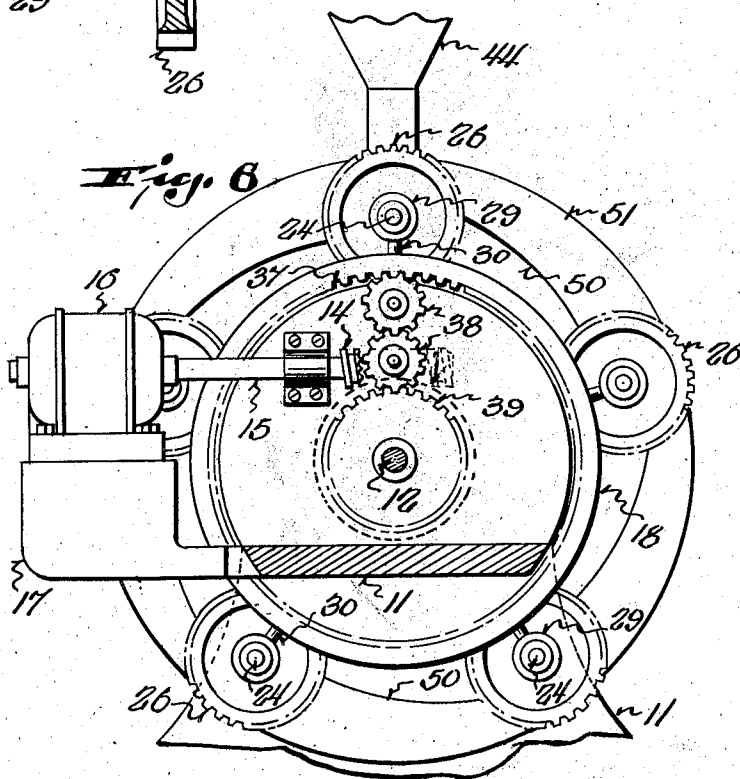
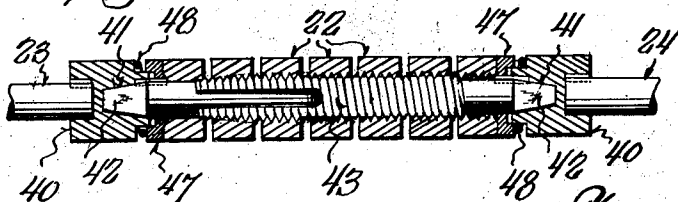


Fig. 7.



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UNITED STATES PATENT OFFICE

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AUTOMATIC TAPPING OR DRILLING
MACHINE

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10 Claims. (Cl. 10—133)

This invention pertains to automatic tapping or drilling machines, and more particularly to that type of machine in which the working tool is detachably held at its opposite ends, and alternately released to permit feeding the work to the tool and delivering the same therefrom.

Heretofore machines of this general type have embodied a single working unit, comprising one working tool. Therefore it is the primary object of the present invention to improve said machines by the provision of a plurality of working units mounted upon a revolvable drum, and adapted to have the work fed progressively to the units and progressively discharged, thus materially increasing production, with possible reduction in the speed of the working units, if desired, thereby prolonging the life of the tools, and eliminating the necessity of frequent replacement.

Incidental to the foregoing, a more specific object resides in the provision of an apparatus comprising a rotatable support, having mounted thereon a plurality of working units of the type described, in combination with means for feeding the work to the units as the support revolves, and actuating the working units during the revolution of the support, during which revolution the working operation is performed and the work successively discharged from the working units.

A further object resides in the provision of positive means for preventing shifting of the working tool upon release of the same by either of the end driving chucks.

A still further object is to provide positive means for stripping the work from the tool upon completion of the working operation and release of the tool at its rear end.

Another object resides in the novel form of drive for the revolvable member and the working units, whereby the speed of operation may be readily varied to compensate for different classes of work.

Lastly, it is an object to provide for chamfering the work during the working operation.

With the above and other objects in view, which will appear as the description proceeds, the invention resides in the novel construction, combination and arrangement of parts, substantially as hereinafter described, and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the herein disclosed invention may be made as come within the scope of the claims.

In the accompanying drawings is illustrated one complete example of the physical embodiment of the present invention constructed ac-

cording to the best mode so far devised for the practical application of the principles thereof.

In the drawings:—

Figure 1 is a longitudinal section through a machine constructed in accordance with the present invention.

Figure 2 is a fragmentary plan section taken on the line 2—2 of Figure 1.

Figure 3 is a vertical, transverse section taken on the line 3—3 of Figure 1.

Figure 4 is a fragmentary detail section taken on the line 4—4 of Figure 1.

Figure 5 is a fragmentary section through the end of one of the driving spindles.

Figure 6 is an end elevation, partly in section, as indicated by line 6—6 of Figure 1, and

Figure 7 is an enlarged detail of one form of working tool, and the end driving chucks and spindles, the work being shown on the tool.

Referring now more particularly to the accompanying drawings, wherein the invention has been illustrated as applied to continuous tapping of nuts, it is to be clearly understood that the principles embodied therein can be readily utilized for the tapping of various articles of irregular shape and contour, and also for the drilling of various articles, without departing from the invention.

With particular reference to Figure 1, the numeral 10 designates a base provided with vertical end supports 11, in which a main shaft 12 is suitably journaled. Secured upon one end of the shaft 12, outside of the end support 11, is a worm gear 13 engaged by the worm 14 mounted upon the drive shaft 15, which is preferably driven by the motor 16 mounted upon a suitable support 17 projecting from the upright 11, thus serving to impart rotation to the main shaft 12, which in turn effects driving of the other elements of the machine, as will be hereinafter explained in detail.

Rotatably mounted about the shaft 12 is a support 18, which in the present instance is illustrated in the form of a drum, although it is to be understood that this may be of any desired shape and construction, inasmuch as its only function and purpose is to support the working units as hereinafter described. Secured to the outer face of the revolvable support 18, at spaced intervals, is a plurality of working units designated in general by the numeral 19, and each comprising a plate 20 secured to the outer face of the support 18 in any suitable manner, and provided with spaced, longitudinal guides 21 for the work 22, which in the present instance is illustrated as conventional nuts, although other forms of work may be ac-

commodated with variations in the form of guides employed.

Positioned adjacent the forward and rear ends of the guides 21 are spindles 23 and 24, respectively, which are journaled in the brackets 25 secured to the outer face of the support 18 in central alinement with the spaced guides 21, the spindles being provided with gears 26 projecting through slots 27 formed in the drum 18, and engaging the gears 28 secured to the main drive shaft 12. As best shown in Figure 5, the gears 26 are keyed on the spindles 23 and 24 to permit longitudinal movement of the spindles, this being obtained by means of the spanner rings 29 secured to the outer ends of the spindles and engaged by the spanners 30, which in turn project through longitudinal slots 31 provided in the drum 18. The shanks of the spanners 30 are provided with flanged extensions 32 slidably engaged in spaced, channeled guides 33, secured to the inner face of the drum 18, while the inner ends of the shanks 30 are provided with rollers 34, which travel in the grooves 35 of the annular cam members 36, which are stationary and secured in any suitable manner to the end supports 11.

Obviously, as the drum rotates about the stationary cams 36, the cam tracks 35 will cause the spanners 30 to be reciprocated, which in turn imparts reciprocative movement to the spindles 23 and 24, at suitable intervals, as will be later described in connection with the operation of the apparatus.

In order to impart rotary movement to the support 18, an internal gear 37 is provided at one end, which is connected thru a pair of gears 38 carried by the end support 11 with a gear 39 secured on the main drive shaft 12, two gears being employed in order to impart movement in the desired direction. In connection with this arrangement of drive it is pointed out that the speed of rotation of the drum 18 can be readily varied, to compensate for different classes of work, by merely changing the gear ratio between the internal gear 37 and the drive.

From the foregoing explanation, it will be readily seen that drive imparted through the motor-driven worm 14, and worm gear 13, to the shaft 12, will cause rotation of the drum 18 through the gears 39, 38, and 37, and as the drum 18 rotates, the gears 26 will have a planetary movement about the gears 28, imparting rotation to the spindles 23 and 24. However, inasmuch as it is desired to drive the gears 26 at a relatively high rate of speed, essential to the working operation, the gears 28, instead of being stationary, are mounted upon the shaft 12, and are rotated in the direction of rotation of the drum at a greater speed than the speed of the drum.

Considering again the tapping or working operation, with particular reference to Figures 1 and 7, it will be noted that the ends of the spindles 23 and 24 are provided with chucks 40, having tapered recesses 41 for reception of the tapered ends 42 of the tap or tool 43. In order to feed the work or nuts 22 to the tap 43, when a working unit 19 is alined with the hopper 44, positioned above the drum 18, and supported by the bracket 45 secured to one of the end uprights 11, the cam track 35 is so formed as to cause the spindle 23 to be drawn outwardly, withdrawing its chuck 40 from the forward end of the tool 43, whereupon a nut 22 is deposited upon the plate 20, between the guides 21, by gravity, after which the spindle 23 is moved forwardly to engage the nut and force the same upon the end of the tool 43 until

the work is engaged by the tap threads, which perform the tapping operation. When this is completed the remaining threads on the tool carry the nut rearwardly towards the discharge end of the tool. Rotation of the drum is so timed that the work is fed to the tool in the spaced relation shown. This prevents any binding or jamming of adjacent pieces of work on the tool, and further facilitates holding the tool against longitudinal movement as the front and rearward chucks are withdrawn. This is accomplished during withdrawal of the front chuck by a spring finger 46 carried by the hopper 44 and adapted to engage between a pair of adjacent work pieces, as best shown in Figure 1, the finger being also indicated in Figure 2, and being inclined at a slight angle in the direction of feed of the work, the work is permitted to pass the finger as it is fed along the tool, and the unit rotates.

The same operation is accomplished during withdrawal of the rear chuck, when a finished piece of work is delivered therefrom, which in the present instance takes place at the lowermost position of the working unit, a finger 46' secured to the base 10 functioning in the same manner as the finger 46.

During the working operation, which takes place as the working units rotate from the feeding position at the top of the drum, to the delivery point at the bottom of the drum, rotation of the tool 43 is so timed as to feed the work one-half the distance of its length. Therefore, a complete revolution of the drum is required to feed the work one length in order that a new nut may be fed to the tool upon each complete revolution, and at the same time the delivery of one nut during a complete revolution.

In some instances, particularly in connection with nuts, it is desirable to chamfer their faces to remove burrs formed by the end threads, and, therefore, in order to accomplish this the chucks 40 are provided with cutting members 47 at their inner ends, the same being slidably mounted and yieldably projected by springs 48 disposed between the chucks and cutting members.

In operation when a nut has been delivered to the plate 20, and the spindle moves forwardly, the nut is engaged by the cutting member and forced over the end of the tool 43 until engaged by the tap threads. Further movement of the chuck creates pressure upon the cutting member, which causes its cutting face to chamfer the engaged face of the nut, it being understood that the movement of the chuck is slightly faster than the feed of the nut upon the tap threads.

After a nut has been fed rearwardly upon the tool, and before the same has left the last thread of the tool, it engages the cutter 47 carried by the rear chuck, which then chamfers the opposite face of the nut, the cutter being forced against the work during its final movement by the spring 48.

Approximately at the time at which the work is about to leave the threads of the tool, the same is engaged by the cam plate 49 secured to the base 10, the same projecting into the spacing between the last nut and the adjacent piece of work. As the work unit then continues to rotate, the rear spindle 24 is withdrawn by the spanner 30, which allows the cam plate 49 to strip the nut from the tool, and discharge the same to any suitable receptacle or chute, not shown. Obviously, the taper provided at the ends of the tool 43, not only facilitates engage-

ment by the chuck, but also reduces the possibility of binding and sticking between the chucks and tool as the chucks are withdrawn.

It will also be noted that the feed threads, following the cutting threads of the tool, are flattened off on their edges, which prevents sticking of the work on the tool, and therefore facilitates feeding of the same, it being understood that the feeding action results from the fact that the nuts are held against rotation by the plate 20 and the guides 21 as the tool rotates.

In order to provide for the successive feeding of a piece of work to each working unit, as the same is alined with the hopper 44, a spiral track 50 connects each unit with the adjacent unit, as best shown in Figure 3, and it will be noted that the forward end of the bottom of the track, which may be provided with side walls 51, is alined with the bottom of the nut supported by the lower nut delivered to the preceding working unit. Then, as the drum revolves, the track rides under the second nut and gradually permits the same to be lowered to alinement with the following unit, thus providing a positive feed of the nuts to the working unit, with the elimination of springs, levers, or other moving parts.

While it is believed that the operation of the invention will be quite apparent from the foregoing explanation, a complete resume includes feeding work pieces to the hopper 14, which may be of any desired construction, and in the event that articles of varying shapes and contours are to be operated upon, naturally agitating means, or the like, may be employed to insure the articles being fed to the machine in the proper position. From the hopper the work is fed to the individual work units, in the present instance by gravity, and after one piece of work has been fed to a unit, the succeeding pieces are supported by the track 50, and each piece is delivered successively to a work unit as the same alines with the hopper. As the work is delivered from the hopper, the cam track 35, provided in the stationary cam 36 at the forward end of the machine, causes the spanner to withdraw the spindle 23 and its chuck to clear the work. As the drum continues to rotate the spindle is moved against the work through the action of the cam 36, the cutter 47 carried by the chuck 40 engaging the work and forcing the same upon the tool until engaged by the working portion of the tool, at which time chamfering of one face of the work takes place, in the event it is desired to perform this operation. Otherwise, the cutter 47 may be eliminated. The work is then tapped or drilled, after which the same is fed along the tool, in the present instance by threads, while in other cases, such as drilling, the work may be chucked and held and the tool fed forwardly.

When the work has reached the rear end of the tool, the machine is so timed that the work is engaged by the cam strip 49, and the rear spindle 24 is then withdrawn in the manner heretofore described, allowing the cam plate 49 to strip the work from its spindle.

The operation of each unit is the same, and inasmuch as each piece of work is fed one length during a complete operation, each unit is capable of completing one piece of work during one revolution.

It will be quite apparent from the foregoing explanation, considered in connection with the accompanying drawings, that a comparatively simple and efficient machine has been devised

for the automatic tapping or drilling of work of various kinds, in which the operations are entirely automatic and positive, and which is capable of the capacity equal to the same number of separate machines as working units provided.

Furthermore, due to the fact that the working operation takes place during the revolution of the units, the speed of such operation can be reduced to a minimum, thereby reducing wear on the working tools, and eliminating frequent replacement.

I claim:—

1. A machine of the class described, comprising a rotatable carriage, a plurality of spaced working units mounted on said carriage, each unit comprising a tool and a work guide, chucks for detachably engaging the ends of said tools, means for imparting rotary movement to said chucks, and means for alternately withdrawing said chucks at different positions of the working units.

2. A machine of the class described, comprising a rotatable carriage, a plurality of spaced working units mounted on said carriage, each unit comprising a tool and a work guide, chucks for detachably engaging the ends of said tool, means for imparting rotary movement to said chucks, means for alternately withdrawing said chucks at different positions of the working unit, and means for engaging the work on said tool during the withdrawal of each chuck for preventing longitudinal movement of said tool.

3. A machine of the class described, comprising a rotatable carriage, a plurality of spaced working units mounted on said carriage, each unit comprising a tool and a work guide, chucks for detachably engaging the ends of said tool, means for imparting rotary movement to said chucks, means for alternately withdrawing said chucks at different positions of the working unit to permit feeding of work pieces to the tool and discharging the same therefrom, means for engaging the work on said tool during the withdrawal of each chuck for preventing longitudinal movement of said tool, means for feeding pieces of work to said units, and means extending between the units for supporting pieces of work during rotation of said carriage and permitting delivery of the same to said working units.

4. A machine of the class described, comprising a rotatable carriage, a plurality of spaced working units mounted on said carriage, each unit comprising a tool and a work guide, spindles journaled at the opposite ends of said tool, tool-engaging chucks carried by the spindles, means for alternately reciprocating said spindles, means for rotating said carriage, and means connected with the carriage drive for driving said spindles.

5. A machine of the class described, comprising a rotatable carriage, a plurality of spaced working units mounted on said carriage, each unit comprising a tool and a work guide, spindles journaled at the opposite ends of said tool, tool-engaging chucks carried by the spindles, means for alternately reciprocating said spindles, means for rotating said carriage, means connected with the carriage drive for driving said spindles, means for feeding work to said tool when one of the spindles is withdrawn, and means for discharging work from said tool when the opposite spindle is withdrawn.

6. A machine of the class described, comprising a rotatable carriage, a plurality of spaced working units mounted on said carriage, each unit comprising a tool and a work guide, spin-

dles journaled at the opposite ends of said tool, tool-engaging chucks carried by the spindles, means for alternately reciprocating said spindles, means for rotating said carriage, means
 5 connected with the carriage drive for driving said spindles; means for feeding work to said tool when one of the spindles is withdrawn, means for discharging work from said tool when the opposite spindle is withdrawn, and means for
 10 engaging the work during the withdrawal of each spindle to prevent longitudinal movement of said tool.

7. A machine of the class described, comprising a rotatable carriage, a plurality of spaced
 15 working units mounted on said carriage, each unit comprising a tool and a work guide, chucks for detachably engaging the ends of said tools, a cutter carried by one of said chucks for chamfering the face of said work, means for imparting rotary movement to said chucks, and means
 20 for alternately drawing said chucks at different positions of the working units.

8. A machine of the class described comprising a rotatable carriage, a plurality of spaced
 25 working units mounted on said carriage, each working unit comprising a tool and a work guide, chucks for detachably engaging the ends of said tools, means for feeding pieces of work to one end of said tool, including a spiral sector adapted
 30 to support the work and guide the same into alinement with said tool at a fixed point in the cycle of rotation of said tool, and means for alternately withdrawing said chucks at different positions of the working units to permit feeding

of the work to said tools and delivery therefrom.

9. A machine of the class described comprising a rotatable carriage, a plurality of spaced
 5 working units mounted on said carriage, each unit comprising a tool, chucks for detachably engaging the ends of said tools, means for imparting rotary movement to said chucks upon rotation of said carriage, means for alternately withdrawing said chucks at different positions of the
 10 working units to permit feeding of work pieces to the tool and discharging the same therefrom, and a cutter yieldably carried by one of said chucks for engaging the face of said work.

10. A machine of the class described comprising a rotatable carriage, a plurality of spaced
 15 working units mounted on said carriage, each unit comprising a tool, chucks for detachably engaging the ends of said tool, means for imparting rotary movement to said chucks, means
 20 for alternately withdrawing said chucks in different positions on the working unit to permit feeding of work pieces to the tool and discharging the same therefrom, a cutter carried by one of
 25 said chucks for engaging the face of said work, means for engaging the work on said tool during the withdrawal of each chuck to prevent longitudinal movement of said tool, and means for
 30 feeding pieces of work to said units, including a spiral track for supporting the work pieces and guiding the same to alinement with said tool during rotation of said carriage.

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